

299-E33-3 (A4854) Log Data Report

Borehole Information:

Borehole: 299-E33-3 (A4854)		Site: 216-B-45 Crib			
Coordinates (WA State Plane)		GWL (ft)¹: 232.55	GWL Date: 11/06/2002		
North 137,666.04 m	East 573,633.13 m	Drill Date Nov. 1954	TOC² Elevation 193.23 m	Total Depth (ft) 236	Type Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.5	8 5/8	8	5/16	+2.5	236
Welded steel	1.3	4 1/2	4	1/4	+1.3	212

The logging engineer measured the casing stickup using a steel tape. The casing diameters were measured with a caliper and a steel tape. Casing thickness was calculated. Measurements were rounded to the nearest 1/16 in. Casing bottoms are as reported on the well as-built (Ledgerwood 1993). The bottom reported by the logging engineer (242.4 ft) is approximately 6.4 ft deeper than the reported completion depth of 236 ft.

Borehole Notes:

Borehole coordinates, elevation, and well construction information, as shown in the above tables, are from measurements by Stoller field personnel and Ledgerwood (1993). The depths have been adjusted to TOC. Zero reference is the top of the 8-in. casing. Top of casing stickup is evenly cut. A reference point survey "X" is located on top of the casing stickup. Surrounding the casing, the ground surface is a 4 ft x 4 ft x 6 in. concrete pad. Grout extends to 209.5 ft (Ledgerwood 1993).

Logging Equipment Information:

Logging System: Gamma 2A	Type: SGLS (35%)
Calibration Date: 10/2002	Calibration Reference: GJO-2002-383-TAC
Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5/Repeat
Date	11/04/02	11/05/02	11/06/02	11/06/02	11/06/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	72.0	171.0	243.0	204.0	169.0
Finish Depth (ft)	3.0	71.0	205.0	170.0	145.0
Count Time (sec)	200	200	100	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	0.5	1.0	1.0

Log Run	1	2	3	4	5/Repeat
ft/min	N/A ³	N/A	N/A	N/A	N/A
Pre-Verification	BA169CAB	BA170CAB	BA171CAB	BA171CAB	BA171CAB
Start File	BA169000	BA170000	BA171000	BA171077	BA171112
Finish File	BA169069	BA170100	BA171076	BA171111	BA171136
Post-Verification	BA169CAA	BA170CAA	BA171CAA	BA171CAA	BA171CAA
Depth Return Error (in.)	-1	0	N/A	N/A	-1.25
Comments	Fine-gain adjustments were made.	Fine-gain adjustments were made.	Fine-gain adjustments were made.	A fine-gain adjustment was made.	A fine-gain adjustment was made.

Logging Operation Notes:

Zero reference was top of the 8-in. casing. Logging was performed without a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (⁴⁰K, ²³⁸U, and ²³²Th) verifier with serial number 082. A 200-s counting time at 1-ft intervals was used to compensate for the second casing above 205 ft; below 205 ft a 100-s counting time at 0.5-ft intervals was used.

Analysis Notes:

Analyst:	Sobczyk	Date:	11/25/02	Reference:	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all within the control limits. The peak counts per second at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 1 and 6 percent of one another.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G2AOct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 8-in. casing. The casing configuration was assumed to be a string of 8-in. casing with a thickness of 0.3125 inches to total depth (243 ft) and a string of 4-in. casing with a thickness of 0.25 in. to a log depth of 214.5 ft. The logging engineer measured these casing thicknesses. Where more than one casing exists at a depth, the casing correction is additive (e.g., the correction for both an 8-in. and 4-in. casing would be $0.3125 + 0.25 = 0.5625$). A water correction was applied to the SGLS data below 232.55 ft.

Dead time corrections are required when dead time exceeds 10.5 percent. Dead time exceeded 10.5 percent in the interval from 65 to 83 ft. Maximum dead time was about 36 percent at 68 ft. At SGLS dead time greater than 40 percent, peak spreading and pulse pile-up effects may result in underestimation of activities.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (⁴⁰K, ²³⁸U, and ²³²Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. In addition, comparison log plots of man-made radionuclides are provided to compare the data collected by Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead

time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs , ^{60}Co , ^{154}Eu , ^{152}Eu , and ^{125}Sb were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in four intervals: from 8 to 9 ft, from 41 to 106 ft, from 121 to 139 ft, and from 220 to 227.5 ft. The maximum apparent activity was 1510 pCi/g at a log depth of 68.0 ft. ^{137}Cs was also detected at 20.0, 114.0, 177.0, and 243.0 ft with concentrations ranging from the MDL (0.2 pCi/g) to 0.8 pCi/g. ^{60}Co was detected continuously from 38 ft through total depth (243 ft). The range of concentrations was from 0.2 to 17.1 pCi/g, which was detected at 117 ft. ^{60}Co was detected below the groundwater depth of 232.6 ft. ^{154}Eu was detected in the interval from 64 through 86 ft at concentrations ranging from 0.6 to 11 pCi/g. ^{152}Eu was detected at 72 ft with a concentration of 1.3 pCi/g. ^{125}Sb was detected in the interval from 59 through 61 ft and at 104 and 128 ft. Concentrations ranged from 1.7 to 2.5 pCi/g.

Comparison log plots of data collected in 1991 by Westinghouse Hanford Company (WHC) and in 2002 by Stoller are included. The RLS concentration data for ^{60}Co , ^{125}Sb , ^{154}Eu , and ^{137}Cs are decayed to the date of the SGLS logging event in November 2002. The SGLS and 1991 RLS logs appear to use a different depth reference, and the RLS logs were shifted 6.5 ft to agree with the SGLS data. Comparison of the SGLS and RLS ^{60}Co data suggests a possible contaminant increase at depth intervals from 45 to 58 ft, 85 to 110 ft, and 155 to 175 ft. The casing correction factor may cause these differences. The maximum casing correction for the RLS data was limited to 0.40-in. thickness and that may cause underestimation of radionuclides above 212 ft. Comparison of the ^{137}Cs concentrations indicates that the RLS data underestimated the radionuclide concentrations. Since 1991, ^{137}Cs , ^{154}Eu , and ^{125}Sb appear to have decreased as predicted by radioactive decay. Concentrations on the SGLS log are slightly higher than that predicted when compared to the 1991 log, and these differences are probably caused by differences in the casing correction. The SGLS did not detect ^{125}Sb between 65 and 95 ft because the relatively high amount of ^{137}Cs increased the MDL for ^{125}Sb in this zone. In 1991, the RLS was able to detect ^{125}Sb because of the relative abundance of this short-lived radionuclide at that time. Because of the apparent changes in this borehole's ^{60}Co profile, it is recommended that this borehole be periodically logged to monitor the changes observed in contaminant profile over the last 10 years. The interval from 140 ft to total depth should be re-logged with the SGLS in 2 years.

Changes in the KUT logs in this borehole that could be attributed to stratigraphy could not be identified with certainty. The reported top of basalt (Ledgerwood 1993) is at 238.5 ft (TOC).

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for both the man-made and natural radionuclides (662, 1173, 1333, 609, 1461, 1764, and 2614 keV).

Gross gamma logs from Additon et al. (1978) (attached) indicate that the sediments surrounding this borehole contained significant amounts of gamma-emitting contamination as early as 1959 through at least 1976. The log from 1/28/59 detected gamma activity above background below 16 ft (5 m) through total depth. The log from 5/4/76 detected gamma activity above background below 23 ft (7 m) through total depth. The SGLS detected ^{137}Cs , ^{60}Co , ^{154}Eu , ^{152}Eu , and ^{125}Sb between 37 ft and total depth.

References:

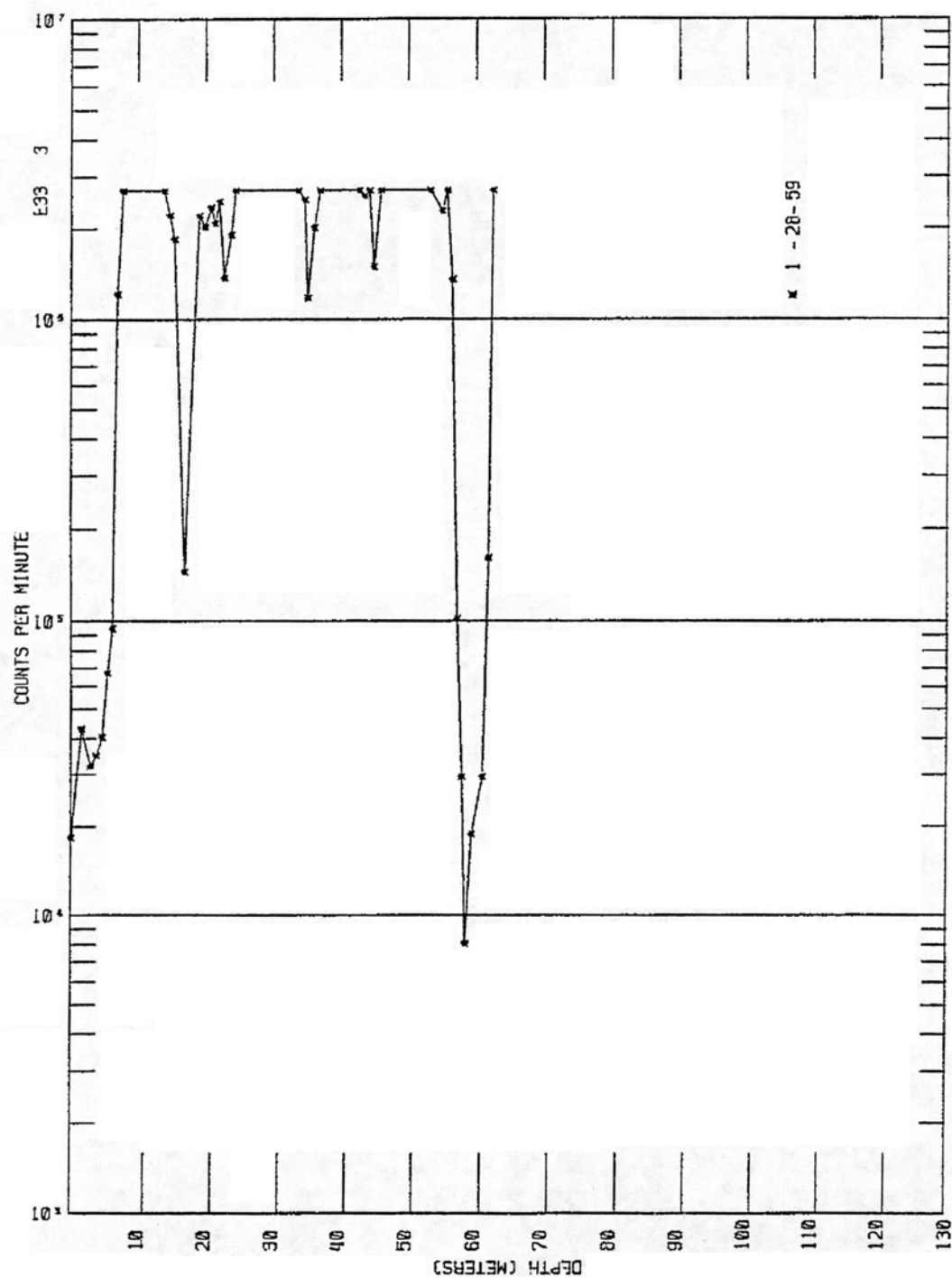
Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Wells*, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

¹ GWL – groundwater depth

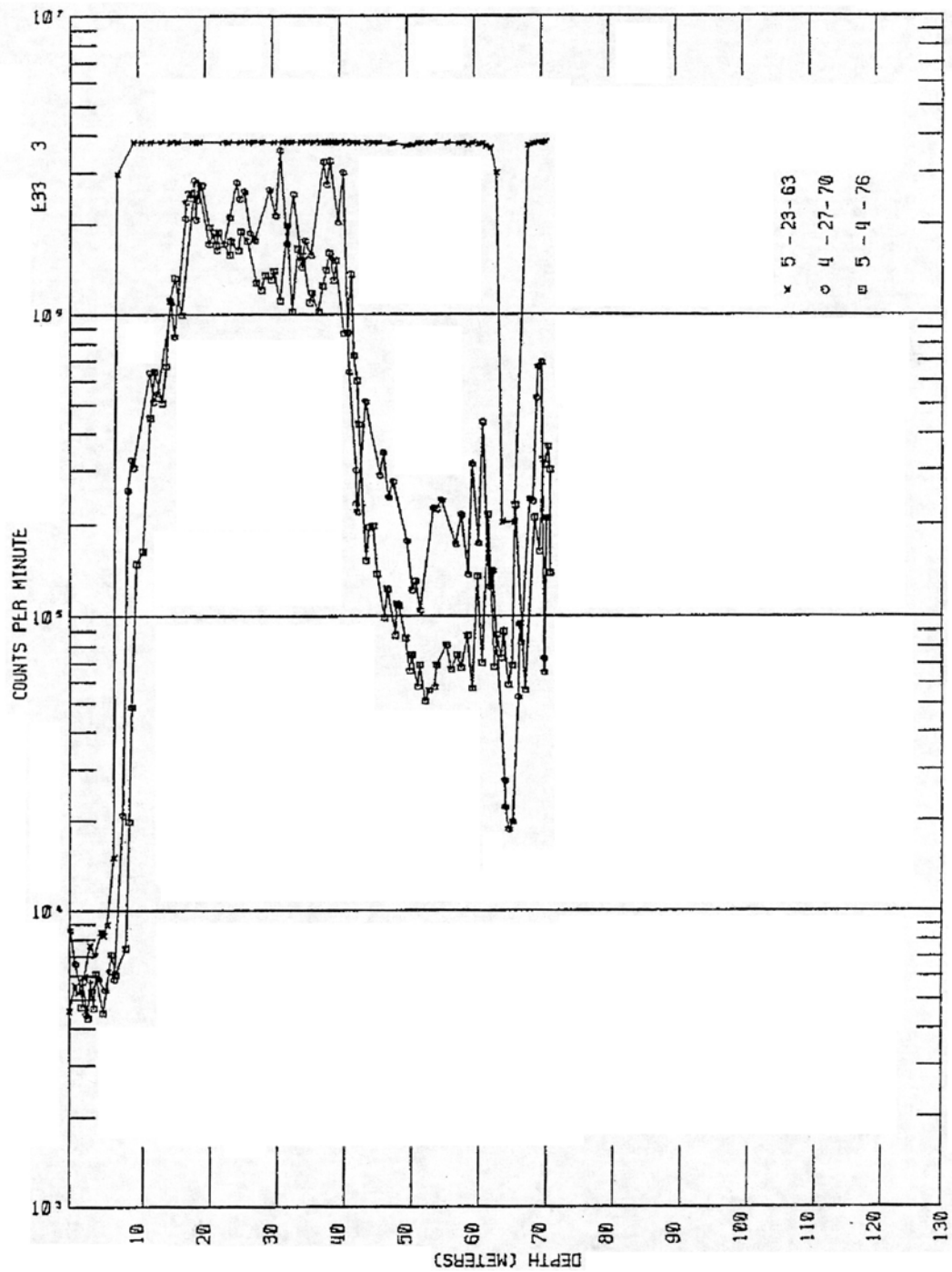
² TOC – top of casing

³ N/A – not applicable



from Additon et al. (1978)

Scintillation Probe Profile for Borehole 299-E33-3, Logged on 1/28/59

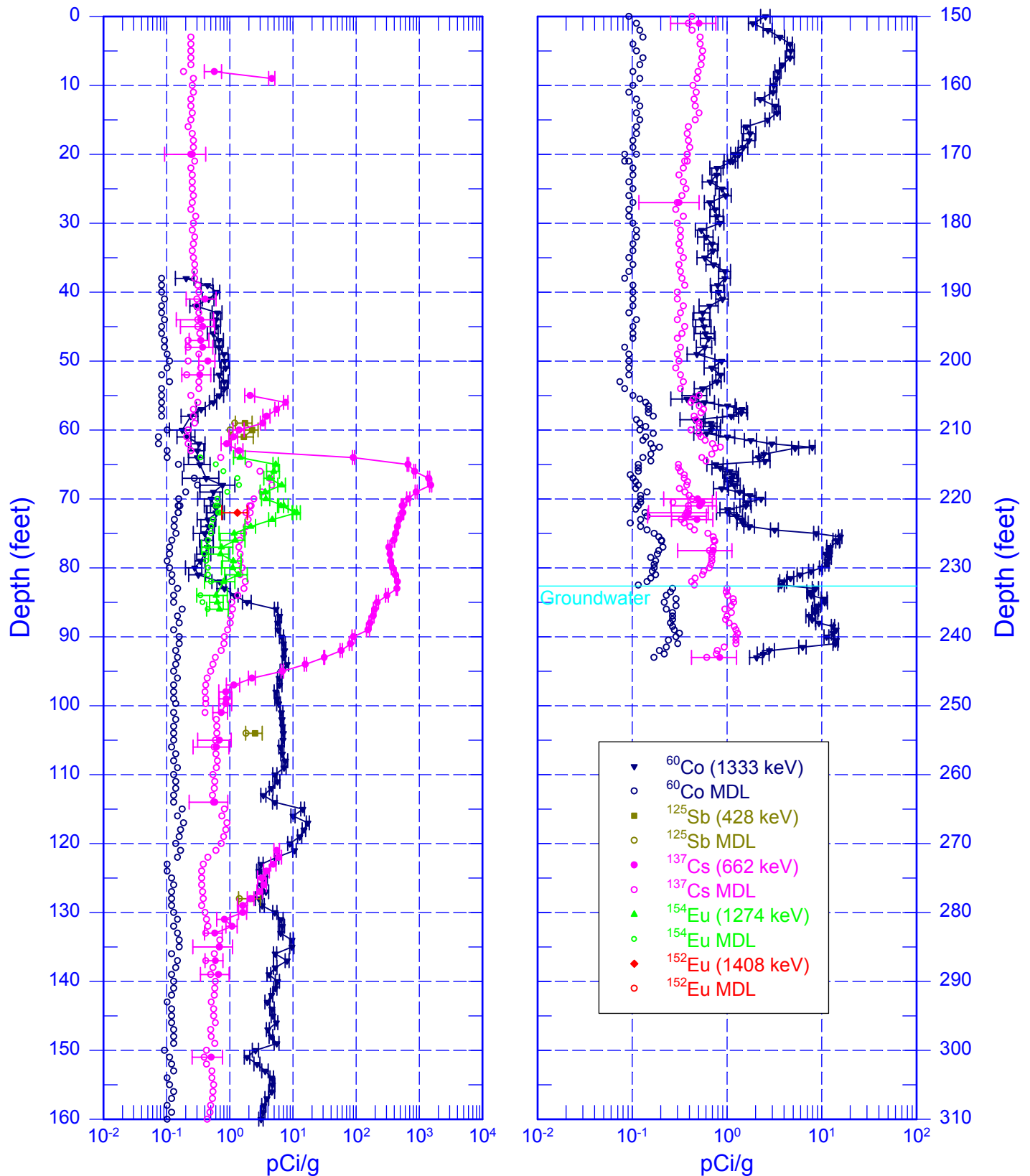


from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E33-3, Logged on 5/23/63, 4/27/70, and 5/4/76

299-E33-3 (A4854)

Man-Made Radionuclides

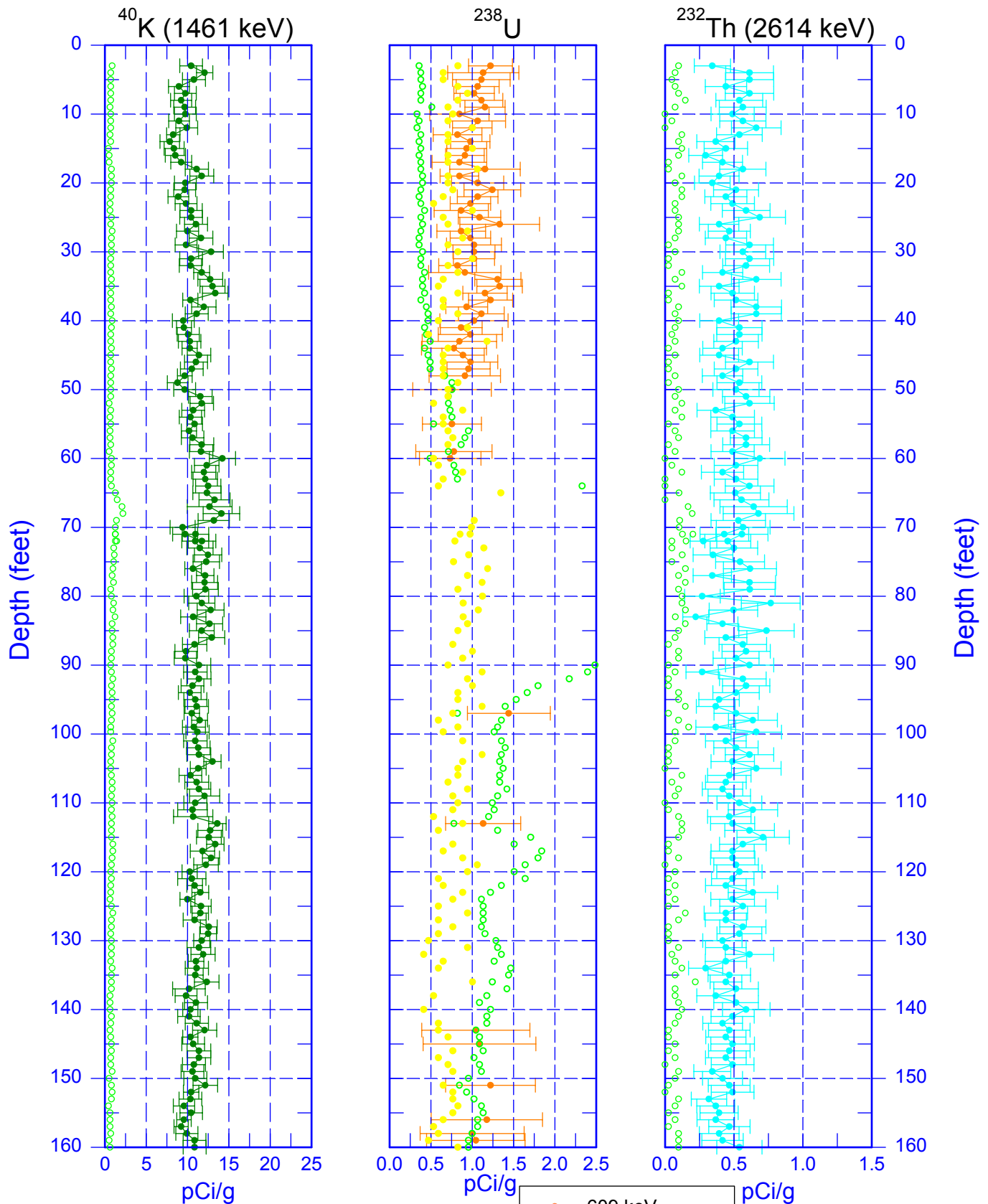


Zero Reference = Top of Casing

Date of Last Logging Run
11/06/2002

299-E33-3 (A4854)

Natural Gamma Logs

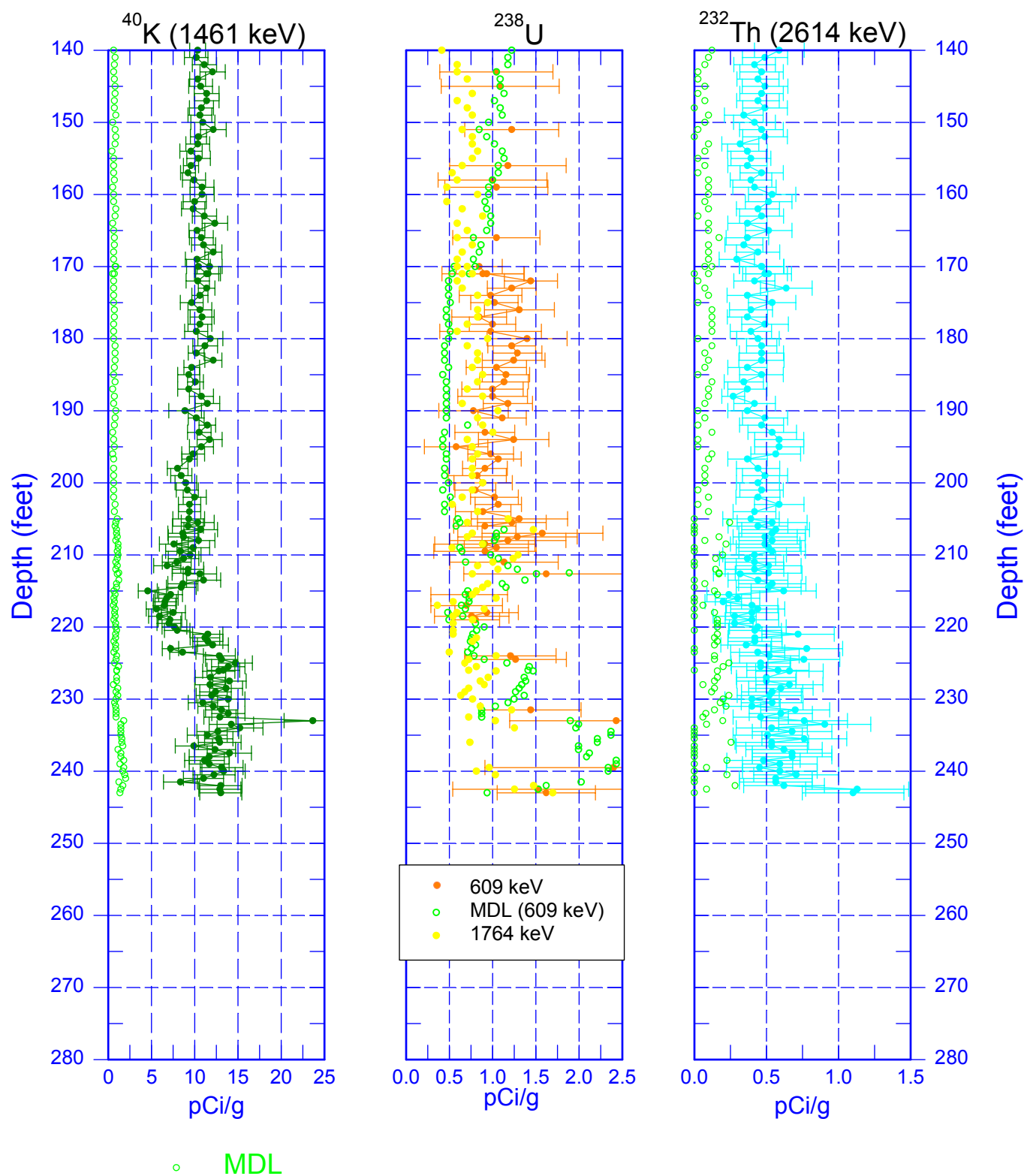


Zero Reference = Top of Casing

Date of Last Logging Run
11/06/2002

299-E33-3 (A4854)

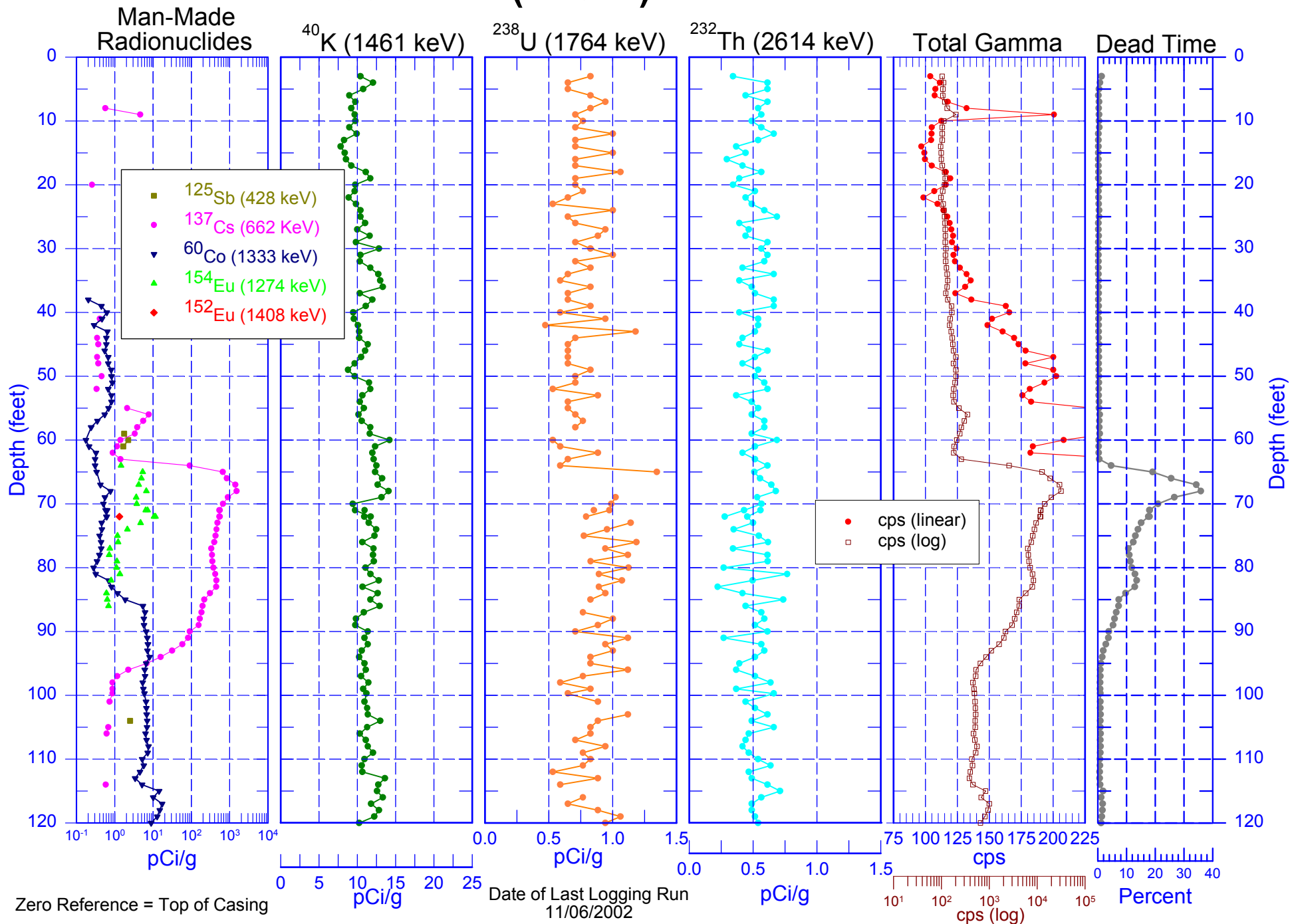
Natural Gamma Logs



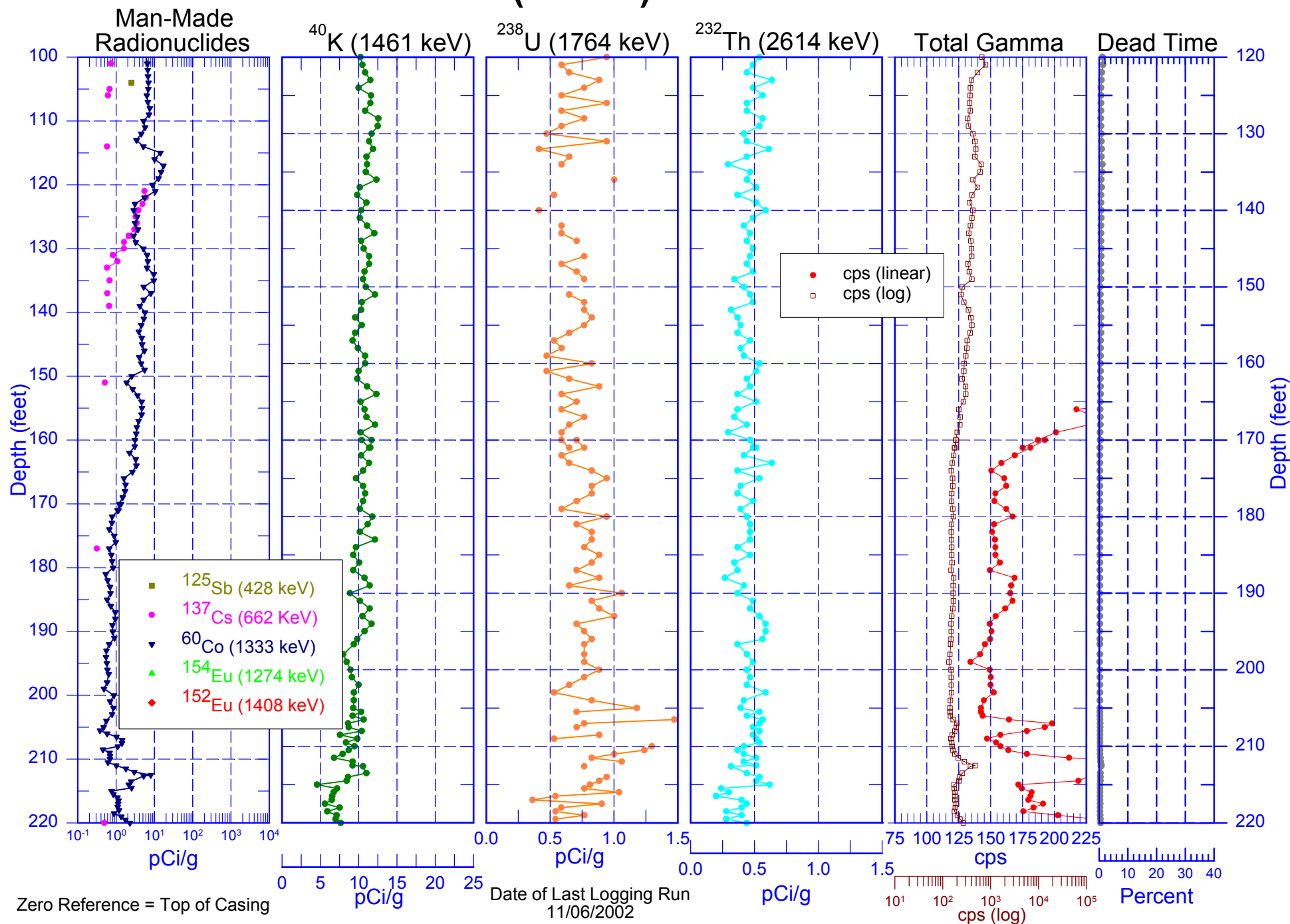
Zero Reference = Top of Casing

Date of Last Logging Run
11/06/2002

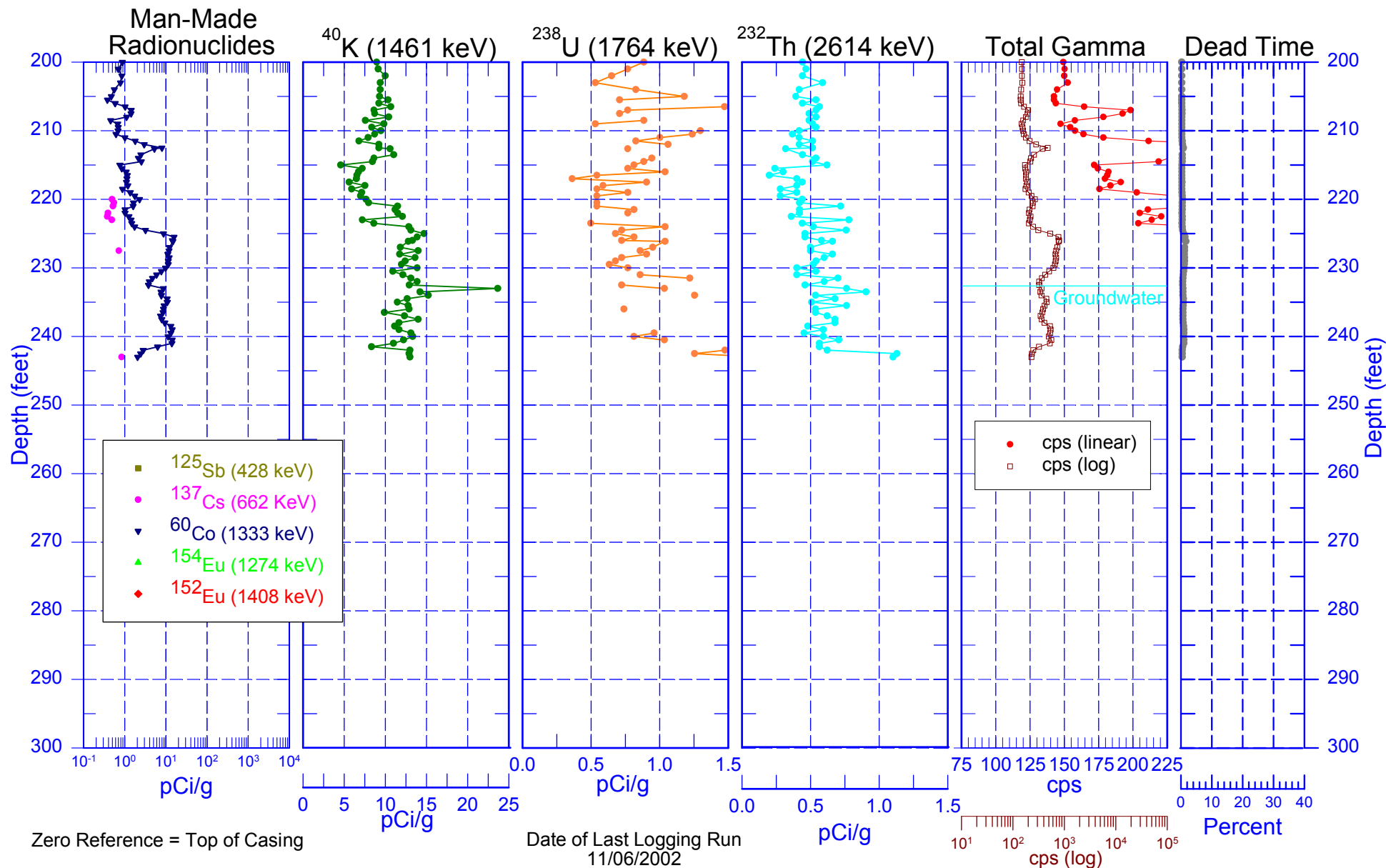
299-E33-3 (A4854) Combination Plot



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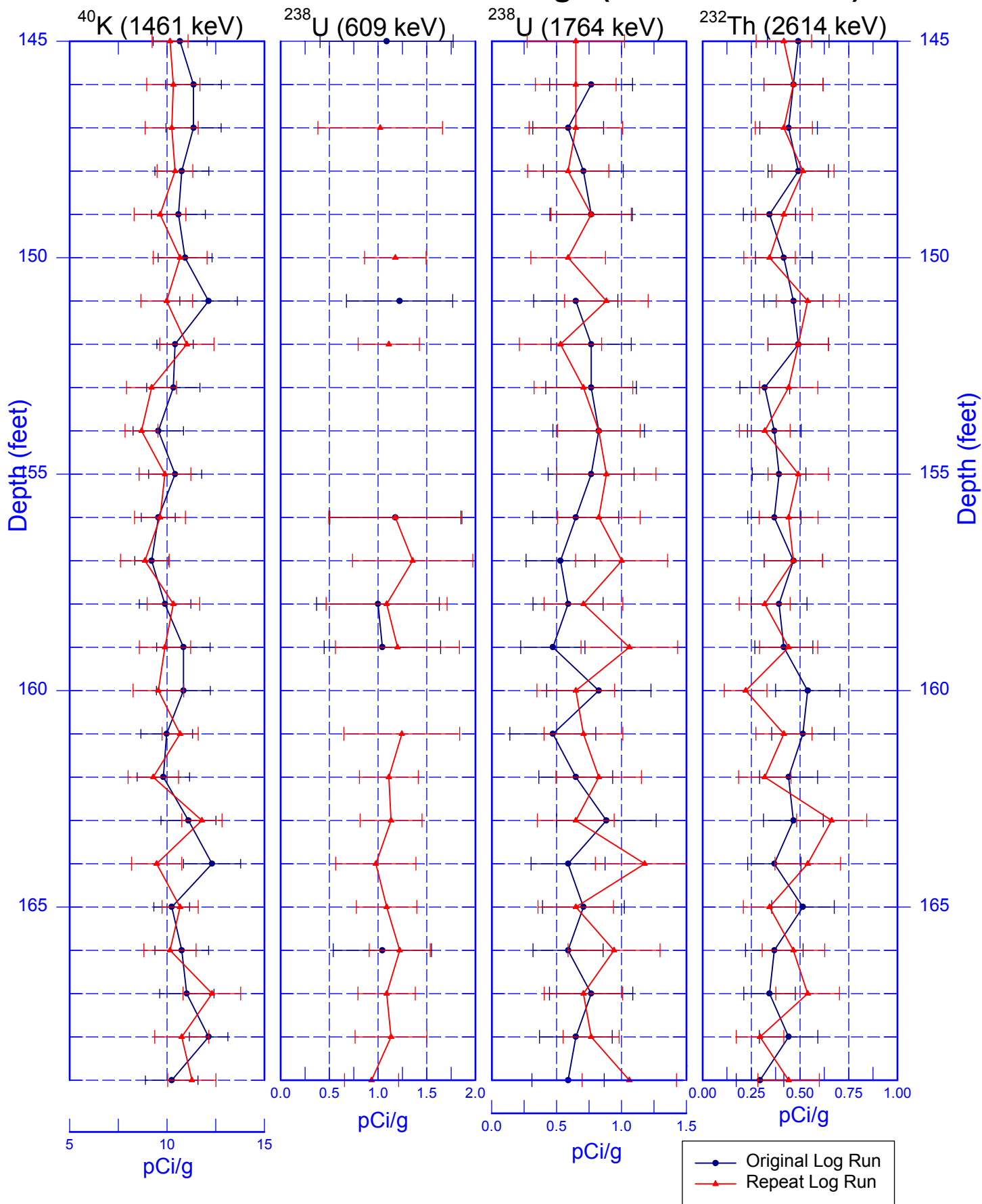


299-E33-3 (A4854) Combination Plot



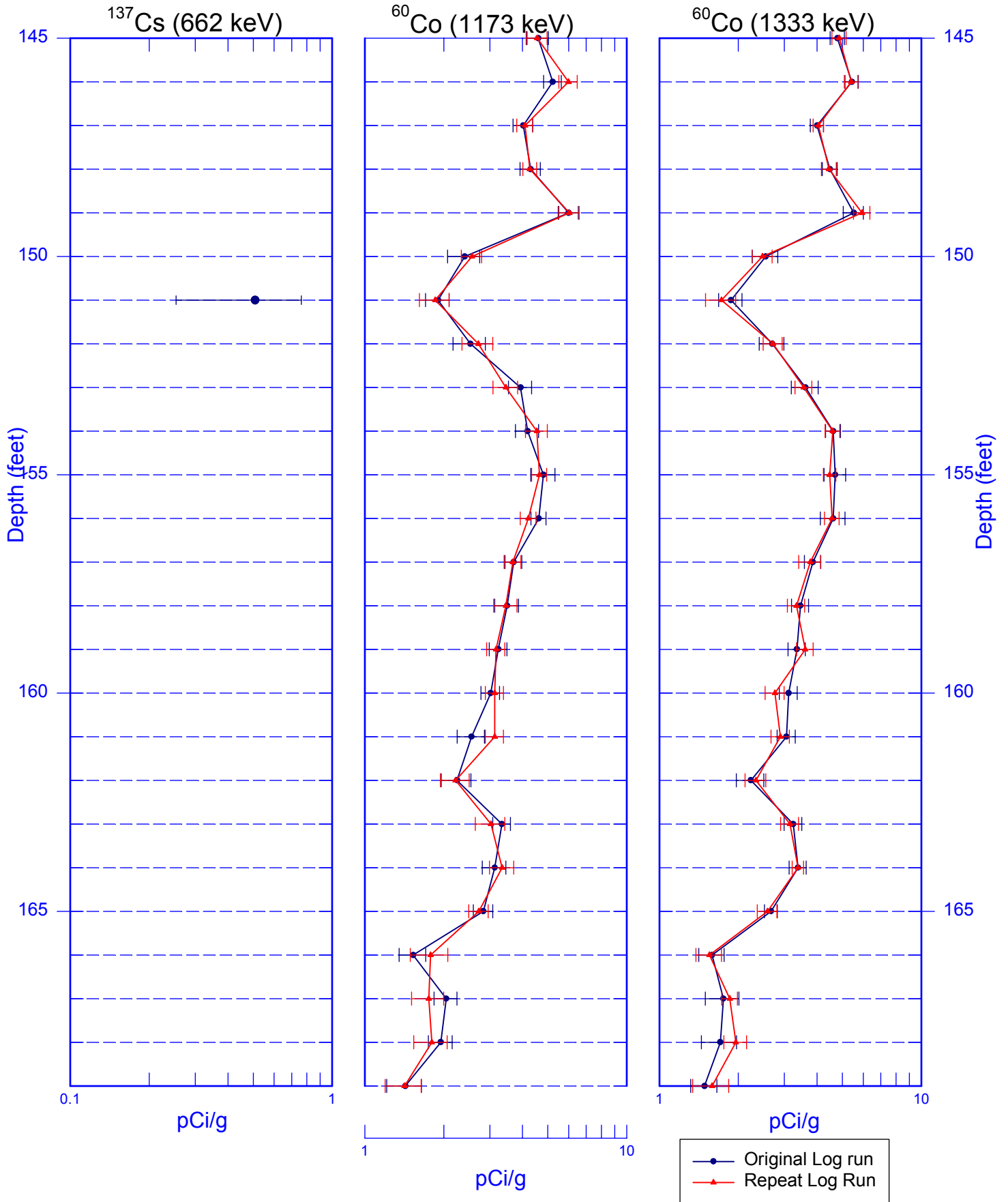
299-E33-3 (A4854)

Rerun of Natural Gamma Logs (169.0 to 145.0 ft)



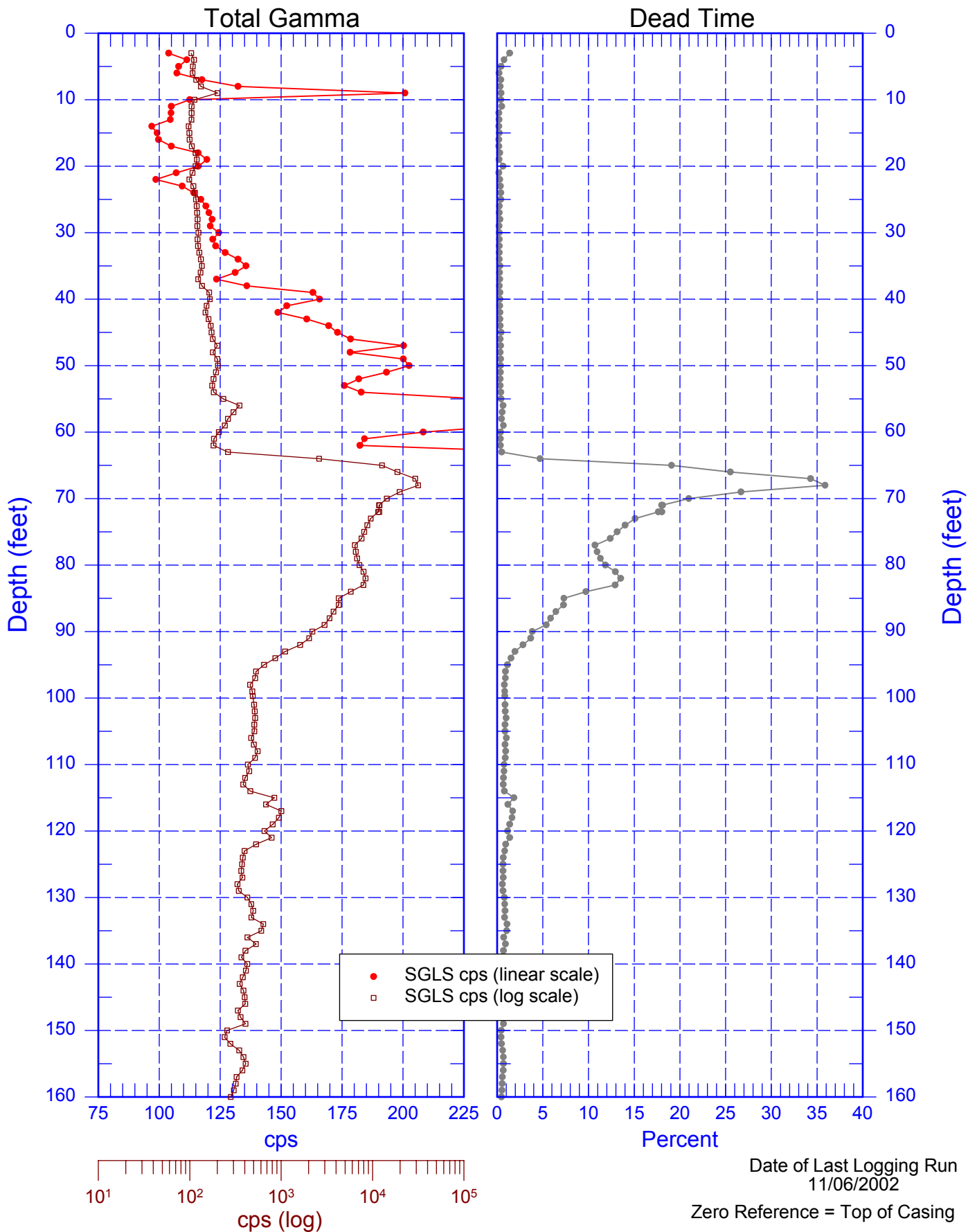
299-E33-3 (A4854)

Rerun of Man-Made Radionuclides (169.0 to 145.0 ft)



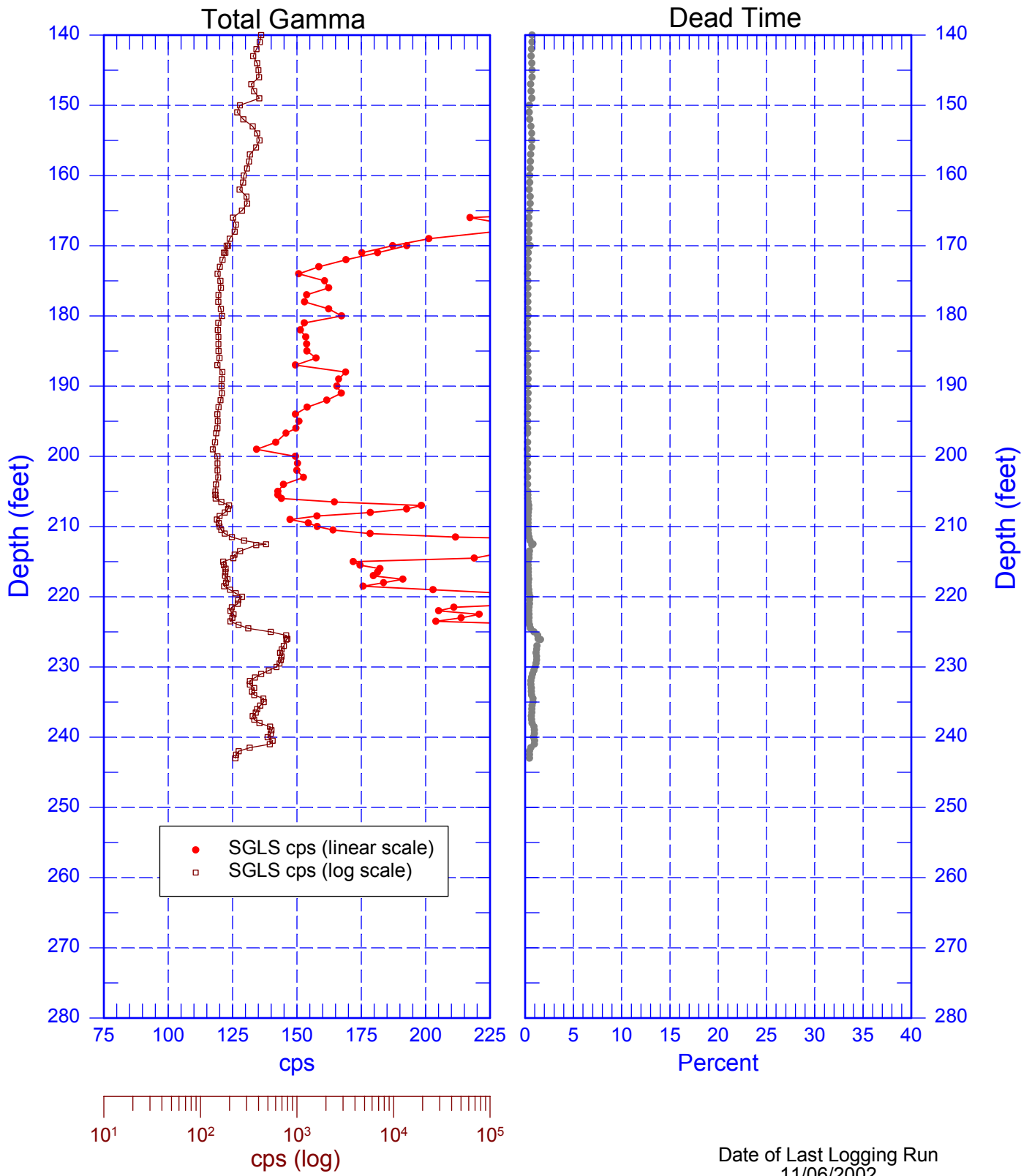
299-E33-3 (A4854)

Total Gamma & Dead Time



299-E33-3 (A4854)

Total Gamma & Dead Time



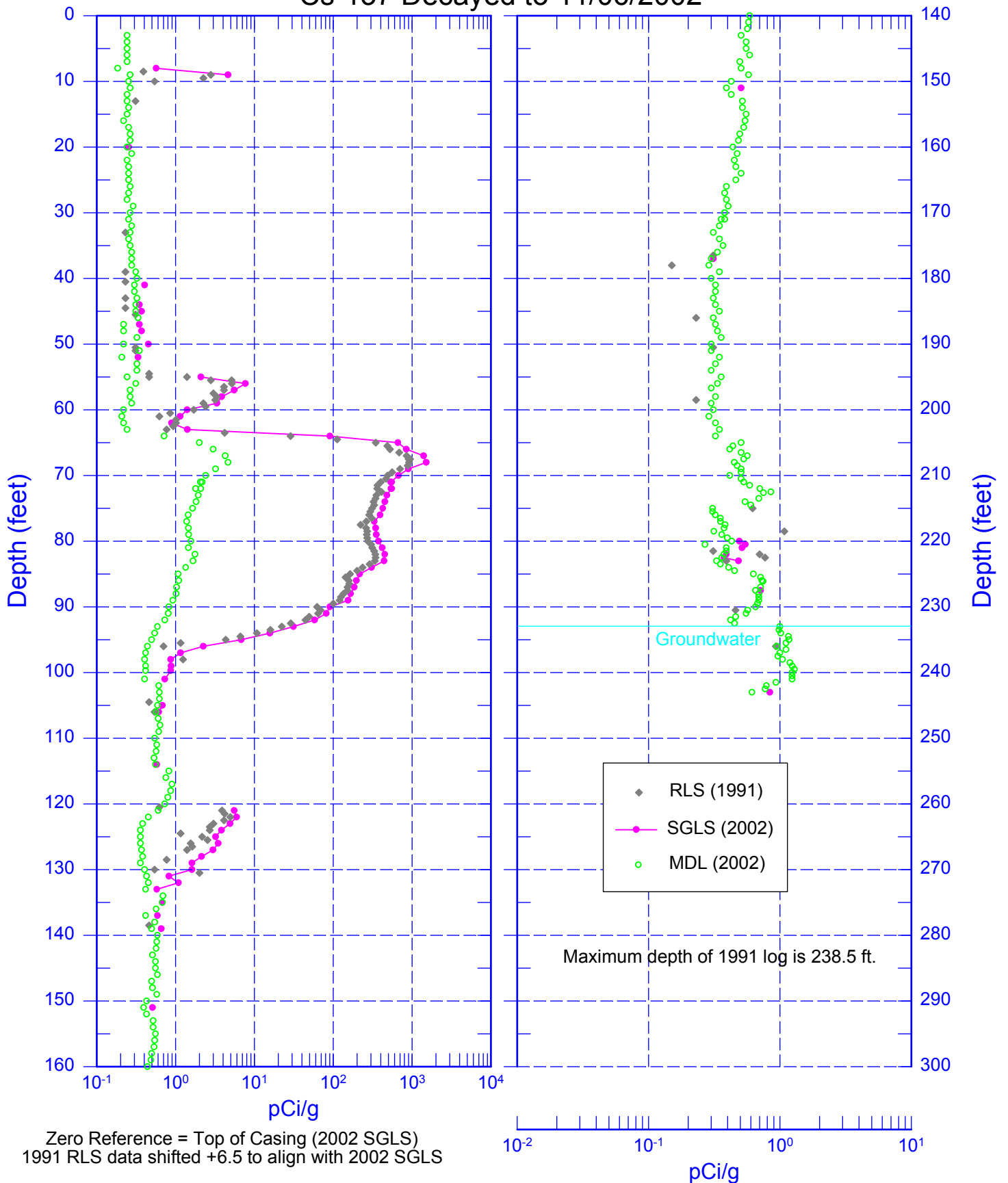
Date of Last Logging Run
11/06/2002

Zero Reference = Top of Casing

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RLS Data Compared to SGLS Data

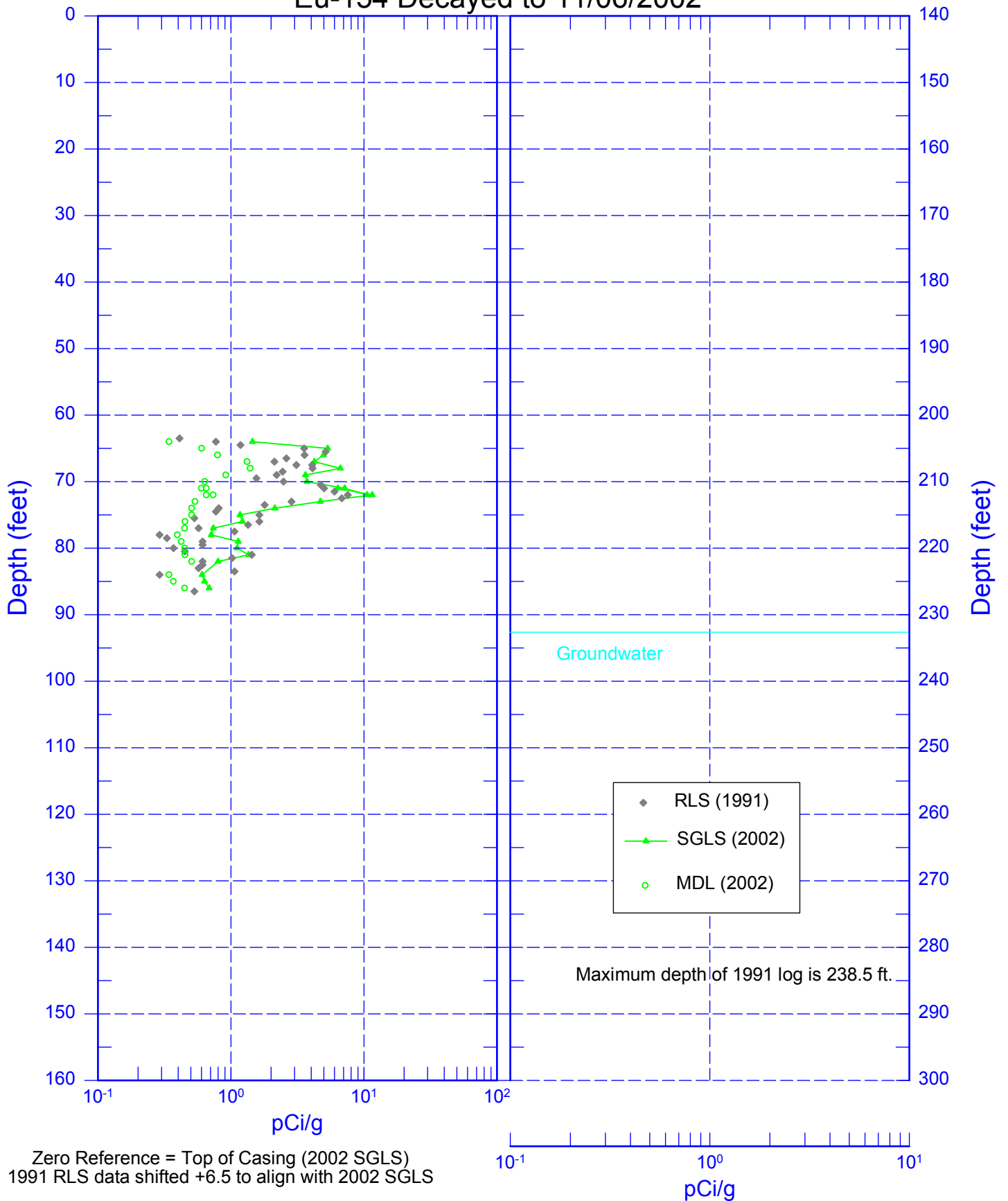
Cs-137 Decayed to 11/06/2002



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RLS Data Compared to SGLS Data

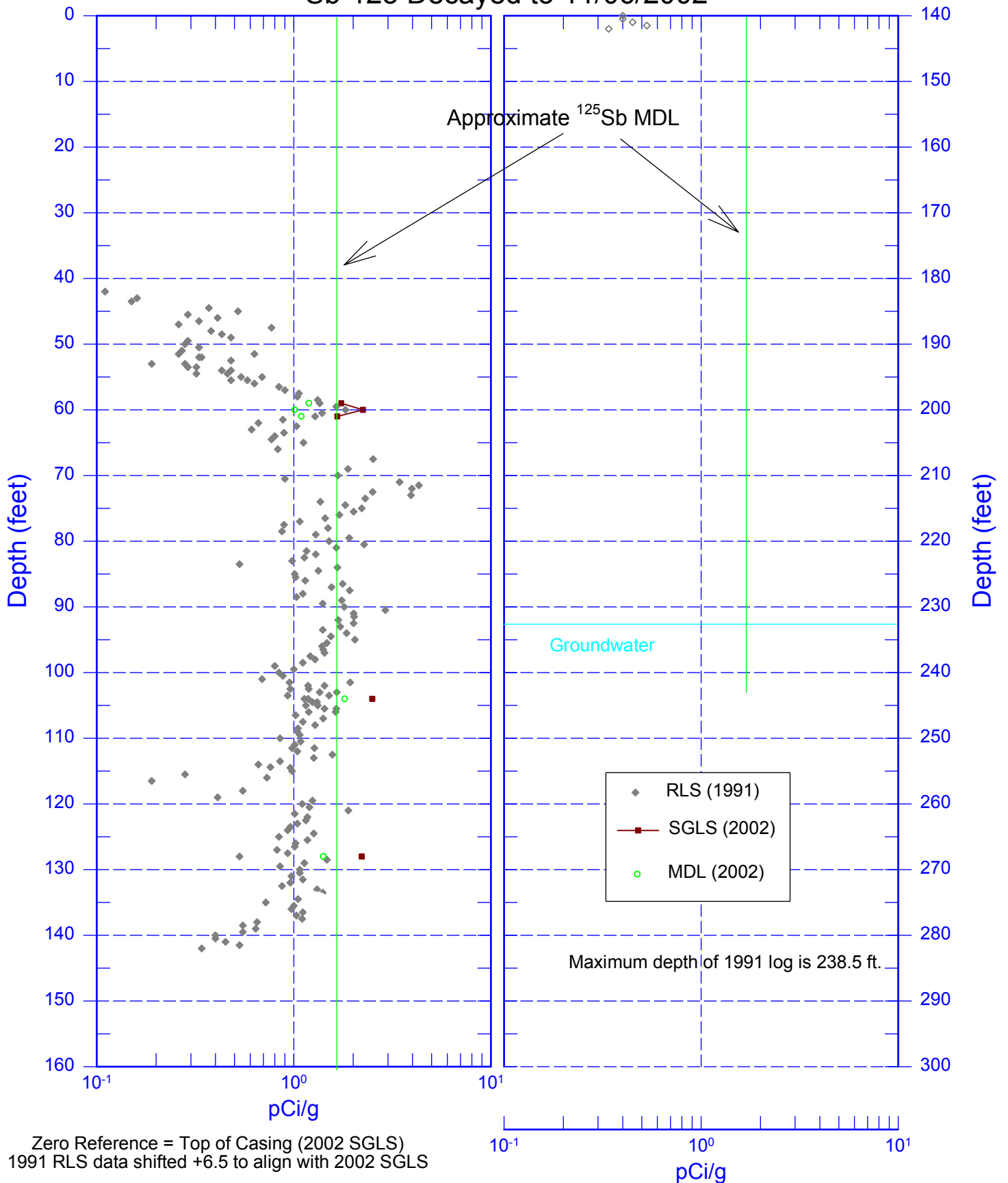
Eu-154 Decayed to 11/06/2002



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RLS Data Compared to SGLS Data

Sb-125 Decayed to 11/06/2002



299-E33-3 (A4854)

RLS Data Compared to SGLS Data

Co-60 Decayed to 11/06/2002

